(19) Europäisches Patentamt
European Patent Office
Office européen des br vets

(11) EP 1 046 979 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
25.10.2000 Bulletin 2000/43

(21) Application number: 99954454.7

(22) Date of filing: 09.11.1999

(51) Int. Cl.⁷: G06F 1/32, G06F 3/12, B41J 29/38

(86) International application number:
PCT/JP99/06236

(87) International publication number:
WO 00/28402 (18.05.2000 Gazette 2000/20)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: 09.11.1998 JP 31761698
09.11.1998 JP 31761798

(71) Applicant:
SEIKO EPSON CORPORATION
Shinjuku-ku, Tokyo 163-0811 (JP)

(72) Inventor:
KAWASE, Yuji,
Seiko Epson Corporation
Suwa-shi, Nagano-ken 392-8502 (JP)

(74) Representative:
Hoffmann, Eckart, Dipl.-Ing.
Patentanwalt,
Bahnhofstrasse 103
82166 Gräfelfing (DE)

(54) **INTERFACE DEVICE, METHOD OF CONTROLLING INTERFACE DEVICE, AND INFORMATION RECORDING DEVICE**

(57) An interface apparatus having a power-saving function, a control method therefor and an information-storing medium are provided. In the interface apparatus having a receiving means for receiving data from a first host unit and a sending means for sending the data received by the receiving means from the first host unit to a second host unit, a wait-state selecting means for selecting a predetermined wait state from a plurality of wait states according to operation of one of the receiving means and the sending means is provided. The state is shifted to a power-saving state as and when required, thereby allowing power consumption to be reduced, while transition to the power-saving state is controlled via the host, thereby allowing commands to be transferred at a high speed. In addition, information required for saving power is received from the host, thereby allowing independently determine a power-saving mode.

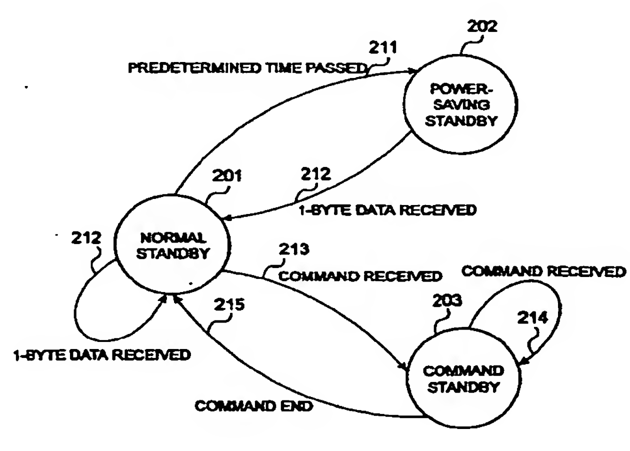


FIG.2

EP 1 046 979 A1

Printed by Xerox (UK) Business Services
2.16.7 (HRS)/3.6

Description

Technical Field

[0001] The present invention relates to an interface apparatus, a control method therefor, and an information-recording medium; particularly, the invention r lates to an interface apparatus that allows data and commands to be transferred between two hosts so as to serve as an interface for communication therebetween, and shifts to a power-saving state as and when required, thereby allowing power consumption to be reduced, and that controls transition to the power-saving state in accordance with the hosts to allow data and commands to be transferred at a high speed; a control method for the interface apparatus; and an information-recording medium for recording a program for controlling the interface apparatus.

Background Art

[0002] As an interface apparatus that serves as an interface for transmission of data and commands between two hosts, an interface apparatus in which one of the hosts is a computer and the other one of the hosts is a printer, an interface apparatus that serves as a hub for connecting multiple hosts, for example, for connecting a computer and a computer, and other various types of interface apparatus are known.

[0003] For sending data and commands from a computer to a printer, them are various cases where they are sent via various types of paths. For example, there are cases where they are sent via a parallel port or an RS-232C port that are included in a computer and where they are sent via a bus widely used in recent years, such as that according to USB (Universal Serial Bus) or according to IEEE (Institute of Electrical and Electronic Engineers) 1394.

[0004] Thus, the type of connector differs in various ways depending on the standards. The connection status on the side of computers may be variable; however, hardware of printers is preferably common. In this situation, an interface apparatus first receives data and commands to be sent through the aforementioned various types of connections and performs voltage-conversion, impedance-matching, buffering of the sent data and commands, and interpretation and filtering thereof; and thereafter, it converts them to, for example, the RS-232C format, and outputs them.

[0005] Thus, by exchanging the interface apparatus, a single printer can be used to meet various conditions. That is, depending on the combination of the interface apparatus and the printer, a printer that complies with various types of connectors can be provided. Thereby, printers can be mass-produc d, thereby allowing costs required for the entire printing unit to be reduced.

[0006] On the other hand, for the interface apparatus, reduction in power consumption is preferable in view of operation costs and environment protection. Many computers and printers are designed to shift to a power-saving state independently of each other while they are not used for a pr d t rmined p riod of time.

[0007] Also, in the described type of the interface apparatus, the reduction in the power consumption is preferable in view of operation costs and environment protection. As power-saving modes for reducing power consumption, there are methods such as that the clock rate of a CPU (central processing unit) that controls the interface apparatus is lowered, and intermittent operations are performed, in which the power-saving modes can be varied by specifying various parameters for the lowering level of the clock, the intermittent-operation rate, and the like.

[0008] However, the conventional interface apparatus involves problems as described below.

[0009] That is, while a first host such as a computer and a second host such as a printer have been developed so as to meet the power-saving requirements and so as to reduce power consumption, almost no development has been implemented for the power-saving in the interface apparatus. Therefore, problems arise in that operation costs increase. These problems are not preferable also in view of the environment protection.

[0010] Also, since the two hosts shift to a power-saving state independently of each other, only one of the hosts is used to control the entire power-saving function of the interface apparatus. This is not practical, because the power-saving status in the other one of the hosts must be considered.

[0011] Therefore, a preferable interface apparatus is such that it recognizes the status of the two hosts, and provides the power-saving function according to instructions from the hosts.

[0012] Also, a desired power-saving mode in a case where it is implemented in a printer that has a high power-supplying capacity differs form in a case where it is implemented in a printer that has a lower power-supplying capacity. However, in the conventional interface apparatus, no measures are taken for the power-saving mode to differ according to the difference in the power-supplying capacity. Therefore, problems arise in that power consumption cannot be sufficiently reduced.

[0013] The present invention is made to solve the above-described problems, and an object thereof is to provide an interface apparatus that allows data and commands to be transferred between two hosts so as to serve as an interface for communication therebetween, and that shifts to a power-saving state as and when required, thereby allowing the power consumption to be reduced, and that controls the transition to the power-saving state in accordance with the hosts to allow data and commands to be transferred at a high speed; a control method for the interface apparatus; and an information-recording medium for recording a program for controlling the interface apparatus.

[0014] Another object of the present Invention is to provide an interface apparatus that receives power r quired for op ration from a connected host and that also receives information requir d for saving power from the host so as to independently d t rmine a power-saving mode; a control method for the interface apparatus; and an information-recording medium for recording a program for controlling the interface apparatus.

Disclosure of Invention

[0015] In order to achieve the aforementioned objects, an interface apparatus of the present invention has a receiving means for receiving data from a first host unit and a sending means for sending the data received by the receiving means from the first host unit to a second host unit, characterized by comprising a wait-state selecting means for selecting a predetermined wait state from a plurality of wait states according to the operation of one of the receiving means and the sending means.

[0016] In this case, it is preferable that the wait-state selecting means comprise a control-command detecting means for interpreting the data received from the first host unit to extract control commands, a normal-wait-state selecting means for selecting a normal-wait state when the data was found by the control-command detecting means to be data other than a control command, a command-wait-state selecting means for selecting a command-wait state when the data was found by the control-command detecting means to be a control command, a command-completion recognizing means for recognizing completion of a control command extracted by the control-command detecting means, a command-wait-state resetting means for resetting the command-wait state and selecting the normal-wait state when completion of the control command is recognized by the command-completion recognizing means, a first clock means for counting the time passed after the normal-wait state is selected, and a power-saving-wait-state selecting means for resetting the normal-wait state and selecting a power-saving wait state when a predetermined time was found by the first clock means to have passed after the normal-wait state is selected.

[0017] According to the described characteristics, the interface apparatus allows data and commands to be transferred between two hosts so as to serve as an Interface for communication therebetween, and shifts to a power-saving state as and when required, thereby allowing power consumption to be reduced, and that does not shift to the power-saving wait state during command reception, thereby allowing commands to be transferred at a high speed.

[0018] Also, in the above, it is preferable That the interface apparatus further comprise a first notifying means for posting a notification to the first host unit when the power-saving wait state is selected by the power-saving-wait-state selecting means.

[0019] The above characteristics allow the provision of the interface apparatus wherein the first host can recognize a current status of the interface apparatus.

[0020] Also, in the above, it is preferable that the interface apparatus further comprise second notifying means for posting a notification to the second host unit when the power-saving wait state is selected by th power-saving-wait-state selecting means. These characteristics allow the provision of an interface apparatus wherein the second host can recognize a current status of the interface apparatus. Particularly, according to th aforementioned notification, the second host can independently shift to the power-saving wait state.

[0021] Also, in the above, it is preferable that the wait-state selecting means comprise a second clock means for counting the time passed after the power-saving wait state is selected, and a power-saving-wait-state resetting means for resetting the power-saving wait state and selecting the normal-wait state when a predetermined time was found by the second clock means to have passed after the power-saving wait state is selected. According to these characteristics, an interface apparatus that repeats the power-saving state and the normal-wait state at a predetermined cycle so as to response to data and commands at a high speed can be provided.

[0022] Also, in the above, it is preferable that the interface apparatus further comprise a third notification means for posting a notification to the first host unit when the power-saving wait state is reset by the power-saving-wait-state resetting means. These characteristics allow the provision of an interface apparatus wherein the first host can recognize a current status of the interface apparatus.

[0023] Also, in the above, it is preferable that th interface apparatus comprise a fourth notification means for posting a notification to the second host unit when the power-saving wait state is reset by the power-saving-wait-state resetting means. These characteristics allow the provision of an interface apparatus wherein the second host can recognize a current status of the interface apparatus.

[0024] Also, in the above, it is preferable that the interface apparatus comprise a control-command interpreting means for interpreting a control command detected by the control-command detecting means, and a power-saving-wait-state inhibiting means for inhibiting selection of the power-saving wait state by the power-saving-wait-state selecting means when a predetermined control command is interpreted by the control-command interpreting means. These characteristics allow the provision of an interface apparatus that can control transition to the power-saving wait state via the first host and that inhibits the transition, thereby allowing data and commands to be transferred at a high speed.

[0025] Also, the interface apparatus of the present invention is characterized by further comprising a

power-supplying means that has a plurality of power-saving modes and that supplies power supplied from the first host unit to th int rface apparatus, wh rein the wait-state selecting means comprises pow r-information receiving means for rec iving power-supplying capacity information of th first host unit via the sending and receiving means, and a first determining means for determining the power-saving mode employed by the power-supplying means according to the power-supplying capacity information of the first host unit, which was received from the power-information receiving means.

[0026] The above characteristics allow the provision of an interface apparatus that receives power required for operation from a connected host and obtains information required for saving power from the host, thereby being capable of independently determining the power-saving mode.

[0027] In the above, it is preferable that the wait-state selecting means comprise a storing means for storing a pair of device-type-name information of the first host and the power-supplying capacity information of the first host; the power-supplying capacity information of the host, which is received from the power-information receiving means, includes the device-type-name information of the first host; and the determining means searches the storing means for the key of data of the device-type-name information of the host, which was received from the power-information receiving means and determines the power-saving mode employed by the power-supplying means according to the obtained power-supplying capacity information of the first host. These characteristics allow the provision of an interface apparatus that can determine a mode most suitable to the power-supplying capacity of a host even in a case wh re the host has no function for sending power-supplying capacity information while it can send the device-type name.

[0028] Also, in the above, it is preferable that the wait-state selecting means comprise a second determining means for recognizing variation in voltage and/or current of power supplied by the first host, thereby det rmining the power-saving mode employed by the power-supplying means. These characteristics allow the provision of an interface apparatus that experimentally measures the power-supplying capacity of a host even in a case where the host can not send the power-supplying capacity information nor can it send information on the device-type name, thereby determining the power-saving mode most suitable to the power-supplying capacity of the host.

[0029] Also, the present invention is very effective as a control method for an interface apparatus. It can be understood when it is considered by replacing the described configuration of the interface apparatus with the control method. In addition, wh-n the control method can be implemented using a computer, an information-storing medium containing a control program therefor is also included in the scope of the present invention. In this case, it is preferable that the information-storing medium be one of a compact disk, a floppy disk, a hard disk, an optical magnetic disk, a digital vid-odisk, and a magnetic tape.

[0030] The invention in the form of such information-storing medium allows the information-storing medium containing the program to be distributed or sold independently of the interface apparatus. By execution of the program in the interface apparatus, the interface apparatus and the control method therefore according to the present invention are realized.

[0031] Particularly, any one of a compact disk (so-called a CD-ROM), a floppy disk, an optical magnetic disk, a digital video disk (so-called a DVD-ROM), and a magnetic tape may be employed as the information-storing medium containing the program. Using one of these information-storing medium, these programs can be installed in existing interface apparatuses.

[0032] In addition, these programs can be registered at a WWW (World Wide Web) site so as to allow users to download and install them on existing interface apparatuses. These embodiments are also included in the technical scope of the present invention.

[0033] In the above and hereinbelow, a printer as a host and a computer as another host are individually employed and described. However, other electronic information apparatuses can be easily employed as hosts, and embodiments so arranged are also included in the technical scope of the present invention.

[0034] Also, the interface apparatus of the present invention can be applied to a network hub, a modem, or the like that serve as an interface for multiple units such as computers. Embodiments so arranged are also included in the technical scope of the present invention.

[0035] Furthermore, an embodiment that can be considered may be such that, between a printer and an interface board to be installed in a printer, the interface board supplies power to the printer. In this case, the printer corresponds to the "interface apparatus", and the interface board corresponds to the "host". An embodiment so arranged is also included in the technical scope of the present invention.

<u>Brief Description of the Drawings</u>

[0036]

FIG. 1 is a block configuration view of an example of an embodiment of an interface apparatus according to the present invention.

FIG. 2 is a state-transition diagram of a first example of an embodiment of an interface apparatus according to the present invention.

FIG. 3 are explanatory views showing an example format of a command used in the interface apparatus according to the present inven-

tion.

FIG. 4 is a state-transition diagram of a second example of the embodiment of the interface apparatus according to the present invention.

FIG. 5 is a state-transition diagram of a third example of the embodiment of the interface apparatus according to the present invention.

FIG. 6 is a block configuration view of a fourth example of an embodiment of an interface apparatus according to the present invention.

FIG. 7 is a flowchart showing a fourth example of an embodiment of a power-saving determining processing of the interface apparatus according to the present invention.

FIG. 8 is a flowchart showing a fifth example of an embodiment of a power-saving determining processing of the interface apparatus according to the present invention.

FIG. 9 is an explanatory drawing showing data on device-type names and power-supplying capacities of the fourth example of the embodiment of the power-saving determining processing of the interface apparatus according to the present invention.

FIG. 10 is a flowchart showing a sixth example of an embodiment of a power-saving determining processing of the interface apparatus according to the present invention.

FIG. 11 shows explanatory drawings showing variations in voltage of power supplied in the fourth example of the embodiment of the power-saving determining processing of the interface apparatus according to the present invention.

Best Mode for Carrying Out the Invention

[0037] Hereinbelow, an embodiment of the present invention is described. Embodiments explained below are just for explanation; therefore, they do not restrict the technical scope of the present invention. Accordingly, it is possible for those skilled in the art to employ embodiments in which some or all elements are replaced with equivalents, and such embodiments should also fall into the technical scope of the present invention.

[0038] FIG. 1 is a block configuration view of an example of the embodiment of the interface apparatus according to the present invention. Hereinbelow, referring to FIG. 1, a description will be given of the configuration of the example of th embodiment according to the present inv ntion.

[0039] In an interface apparatus 101, a receiving section 112 receives data and commands that are sent from a first host 111 (for example, a computer), and also, the data and commands are sent from a second sending section 123 to a second host 121 (for example, a printer). This is a basic flow of data and commands. However, with the additional provision of a second receiving section 122 and a first sending section 113, data and the commands can also be sent from the s c-ond host 121 to the first host 111.

[0040] When a section such as the first receiving section 112 receives data and commands, an interrupt is generated for a CPU 131 (central processing unit), and the CPU 131 executes reception-interrupting processing. Thus, the CPU 131 controls transmission. A program for implementing control that is executed by the CPU 131 is stored in a ROM 132 (read-only memory). When the interface apparatus 101 is powered on, the CPU 131 reads out the program therefrom and executes it.

[0041] In addition to the aforementioned functions, by using the first sending section 113, a notification on a current status of the interface apparatus 101 can be posted to the first host 111. An embodiment excluding the aforementioned sending section 113 is also included in the technical scope of the present invention.

[0042] The second sending section 123 sends commands and data that are received from the first host 111, and in addition, can post a notification on a current status of the interface apparatus 101 to the second host 121.

[0043] A power control section 133 controls electrical current, voltage, clocks, and the like, which are fed to sections such as the CPU 131, the first receiving section 112, the sending section 113, the second receiving section 122, and the second sending section 123. Thereby, it either turns them to a power-saving stat or returns them from the power-saving state to a normal state.

[0044] A timer 134 is used to check whether or not a predetermined time has passed. The CPU 131 issues commands to the power control section by referring to passed time counted by the timer 134.

[0045] Data can be exchanged among the first receiving section 112, the sending section 113, the second receiving section 122, the second sending section 123, the CPU 131, and the ROM 132 via a bus 136.

[0046] To transfer data and commands from the side of the first host 111 to the bus 136, the first receiving section 112 performs conversion of voltage, current, impedance, frequency, protocols (communication procedures), and the like. To transfer data and commands from the bus 136 to the side of the second host 121, the second sending section 123 performs conversion of

voltage, current impedance, frequency, protocols, and the like. Depending on the case, the CPU 131 can govern the aforementioned conversion.

[0047] Also, a RAM (random access memory), not shown, may be connected to the bus 136. In this case, the RAM may be used either as a temporary storage area or as a buffer area for data and commands that are transferred.

[0048] The first receiving section 112 functions as a rec iving means; the second sending section 123 functions as a sending means; the CPU 131 functions as a shifting means for first to sixth transitions and a setting means in cooperation with, for example, the timer 134 and the power control section 133; the sending section 113 functions as first and third notifying means; and the second sending section 123 functions as second and fourth notifying means.

[0049] FIG. 2 shows a state-transition diagram of a first example of the embodiment of the interface apparatus according to the present invention. Hereinbelow, referring to FIG. 2, a description will be given of an operational flow according to the first example of the interface apparatus according to the embodiment of the present invention.

[0050] After having been powered on, the interface apparatus 101 is in a normal-wait state 201. The timer 134 counts the time passing after it turned to the normal-wait state 201.

[0051] When the passed time counted by the timer 134 exceeds a predetermined time (for example, 10 seconds), the CPU 131 drives the power control section 133 and shifts the entire interface apparatus 101 to a power-saving state 202. This is a first transition 211.

[0052] On the other hand, if the first receiving section 112 receives data sent from the first host, either while the predetermined .time from the moment when the state turned to the normal-wait state 201 has not yet passed or while being in the power-saving state 202, an interrupt is generated for the CPU 131. In interrupt processing, either the data is sent to the second host 121 via the second sending section 123 or the data is buffered in the RAM and, thereby, the transmission is r served. In addition, the state shifts to the normal-wait state 201. This is a second transition 212.

[0053] Regarding methods for identifying whether a received byte is data or a command, a description will be given later.

[0054] If the first receiving section 112 receives a command sent from the first host, either while the predetermined time from the moment when the state turned to the normal-wait state 201 has not yet passed or while being in the power-saving state 202, an interrupt is generated for the CPU 131. In interrupt processing, either the command is sent to the second host 121 via the second sending section 123 or the command is buffered in the RAM and, thereby, the transmission is reserved. In addition, the state shifts to a command-wait state 203. This is a third transition 213.

[0055] In most cases, commands are sent in series, or a large number of commands are sent. Therefore, it is pref rable that th stat does not to shift to the power-saving state 202. Also, generally, it takes time for the state to return from th power-saving state, the above is pr ferable to prevent reduction in throughput, which is caused thereby. In the present embodiment the state cannot be shifted from the command-wait state 203 to the power-saving state 202.

[0056] In the command-wait state 203, if the first receiving section 112 receives a command sent from the first host, an interrupt is generated for the CPU 131. In interrupt processing, either the command is sent to the second host 121 via the second sending section 123 or the command is buffered in the RAM and, thereby, the transmission is reserved. The state remains in the command-wait state 203. This is a fourth transition 214. This is intended for performing high-speed transfer of the command.

[0057] In the command-wait state 203, if completion of a command is detected, the state shifts to the normal-wait state 201. This is a fifth transition 215. The shift is provided for the reason that, since the command transmission from the first host 111 is completed, the state is returned to the normal-wait state 201 wherefrom the state is ready to shift to the power-saving state 202.

[0058] Thus, the state is shifted as required from the normal-wait state 201, the power-saving state 202, or the command-wait state 203 that corresponds to data and the command sent from the first host 111 and the passed time as counted by the timer 134. Thereby, two objects, high-speed transfer and power-saving, can be achieved.

[0059] In this connection, for distinguishing between data and a command so that the command completion can be detected, the methods as described below can be considered.

[0060] A first method is according to an embodiment that uses different formats of data to be sent for the command and data. An exemplary method is such that, in a case where communication is performed in the units of eight bits, that is, one byte, values (128 to 255, or 0x80 to 0xff in the hexadecimal notation) each having the highest-order bit turned ON are used for a command, and values (0 to 127, or 0x00 to 0x7f in the hexadecimal notation) each having the highest-order bit cleared are used for data.

[0061] In this case, a method that can be used is such that, in the command-wait state 203, when one byte is received, first of all, the one byte is sent or reserved in the RAM to be sent to the second host 121, then, verification is performed whether or not the highest-order bit of the one byte is turned ON. If it is turned ON, the command-wait state 203 is allowed to continue according to the fourth transition 214. If it is not turned ON, the state is shifted to the normal-wait state 201 according to the fifth transition 215.

[0062] A second method is according to an embod-

iment arranged such that a command is started with a specific byte, the length of the entire command is included in the first part f the command, and the length is compared with the numb r of bytes receiv d, thereby determining whether or not transfer of the command has been completed. For example, suppose the first byte of a command is either 27 (0x1b in the hexadecimal notation) or 28 (0x1c in the hexadecimal notation). In the former case, the first byte is followed by one byte indicating the length n of the subsequent entire command. In the latter case, the first byte is followed by two bytes indicating the length m of the subsequent entire command. FIG. 3(a) is an explanatory view of a format starting with 0x1b, and FIG. 3(b) is an explanatory view of a format starting with 0x1c.

[0063] In the present embodiment, the state turns to the command-wait state upon receipt of 0x1b, and value n of the byte subsequently received represents the subsequent command length, and completion of the command is detected when the n-th byte is received thereafter. This similarly applies when 0x1c is received.

[0064] FIG. 4 shows a state-transition diagram of a second example of the embodiment of the interface apparatus according to the present invention. The same reference symbols are used for states similar to those in the state-transition diagram shown in FIG. 2. Hereinbelow, referring to FIG. 4, a description will be given of an operational flow of the second example of the embodiment according to the present invention.

[0065] The second embodiment is almost the same as the first embodiment, but is different in that it employs a sixth transition 216. In the present embodiment, the passed time is counted by the timer 134 after the state turns to the power-saving state 202, and the state returns to the normal-wait state 201 according to the sixth transition 216 after a predetermined time (for example, 10 seconds) passes.

[0066] At this time, in conjunction with the sixth transition 216, the CPU 131 can post a notification regarding the state returning to the normal-wait state 201 to the first host 111 via sending section 113 and to the second host 121 via the second sending section 123.

[0067] Also, in the present embodiment, in conjunction with the first transition 211, the CPU 131 can post a notification regarding the state shifting to the power-saving state 202 to the first host 111 via the sending section 113 and to second host 121 via the second sending section 123.

[0068] According the aforementioned notification, the first host 111 and the second host 121 can determine whether or not the interface apparatus 101 is in the power-saving state.

[0069] As a matter of course, an embodiment may be such that one or a plurality of notifications is posted, or no notification is posted.

[0070] FIG. 5 shows a state-transition diagram of a third embodiment of an interface apparatus according to the present invention. The same reference symbols are used for states similar to those in the state-transition diagrams shown in FIGS. 2 and 4. Hereinbelow, referring to FIG. 5, a description will be given of an operational flow of the third embodim nt according to the pr s nt invention.

[0071] The third embodiment is almost the sam as the first embodiment, but it is different in that the first transition 211 in the latter case is divided into a first transition 211 and a first-a transition 211a.

[0072] In the third embodiment, when the interface apparatus 101 receives a command, in addition to th above-described processing, the CPU 131 checks whether the command is a power-saving-wait inhibiting command, a power-saving-wait enabling command, and any other command. If the command is the power-saving-wait inhibiting command, the fact that the power-saving wait state is currently inhibited is recorded in the RAM or the like. If the command is the power-saving-wait enabling command, the fact that the power-waving wait state is currently enabled is recorded.

[0073] In a case where, from the information recorded in the RAM or the like, the power-saving wait state is found to be inhibited even after time exceeds a predetermined time, the CPU 131 does not select the first transition 211, but selects the first-a transition 211 a to allow the normal-wait state 201 to continue.

[0074] Another implementing method that can be considered is such that the CPU 131 commands the timer 134 to stop counting the passed time when the power-saving-wait inhibiting command is received, and the CPU 131 allows the timer 134 to count the passed time when the power-saving-wait inhibiting command is received. When the timer 134 is stopped, since the state where the predetermined time passes over is not detected, the normal-wait state 201 continues.

[0075] In this context, an embodiment may be either such that the power-saving-wait inhibiting command and the enabling command are passed on from th interface apparatus 101 to the second host 121 or such that the commands are not passed on thereto. In th former case, the interface apparatus 101 performs filt r-ing processing for the commands sent from a first host 111 to the second host 121. In the latter case, according to receipt of the commands by the second host 121, the second host 121 even in the power-saving state is allowed to return therefrom to the normal-wait state; thereby, it can start preparation for receiving a large number of commands and a large amount of data.

[0076] In the above, the second embodiment and the third embodiment have been separately described. However, a combined embodiment of these embodiments may be employed. The combined embodiment is also included in the technical scope of the present inv ntion. Particularly, according to principles of the pr sent invention, those skilled in the art employ an embodiment allowing the first host 111 to monitor and control the power-saving state of the interface appara-

tus 101, and in addition, allowing the first host 111 to manage the power-saving state of the second host 121. This particular embodiment is also includ d in the technical scope of the present invention.

[0077] To use the interface apparatus 101 as an interface between a printer and a computer, an embodiment may be such that the interface apparatus 101 of the present invention is entirely inserted into an extension slot of a printer. In such embodiment, since the interface apparatus 101 and the printer are integrated into a single unit, it looks like a single printer when viewed from the outside. Therefore, connection of cables and transportation can be easily carried out, and restrictions regarding the space for installation of components are reduced. Internally, two apparatuses, that is, the interface apparatus 101 and a printer, operate. However, each of the apparatuses is constructed to have a power-saving function; therefore, the integrated unit functions as a power-saving printer.

[0078] The first host 111 and the second host 121 are not in the relationship of a master and a slave. Therefore, for example, the first host 111 is may be a printer, and the second host 121 may be a computer, wherein data representing printer-status information can be exchanged therebetween. Also, the printer can be used so as to control the power-saving function of the interface apparatus 101.

[0079] Also, when both the first host 111 and the second host 121 are computers, the interface apparatus 101 of the present invention is capable of serving as a power-saving hub for networks. An embodiment so arranged is also included in the technical scope of the present invention. In this case, a component that corresponds to, for example, the "command or "data" comprises a data packet, in which determination is made whether a high-speed transfer is required or whether a delayed transfer is permitted. For example, in a case where TCP/IP is used as communication protocol, communication can also be made with a hub. Therefore, the communication with the hub can be used for transmission of a power-saving definition command.

[0080] Hereinbelow, a description will be given of a fourth embodiment of the present invention. FIG. 6 is a block configuration view of an example of the embodiment of an interface apparatus according to the present invention. Hereinbelow, referring to FIG. 6, a description will be given of the configuration of the example of the embodiment according to the present invention.

[0081] In an interface apparatus 101, a receiving section 112 receives either data or commands that are sent from a first host 111 (for example, a computer), and they are sent from a second sending section 123 to a second host 121 (for example, a printer). This is a basic flow of data and commands. However, with the additional provision of a second receiving section 122 and a first sending section 113, data and commands can also be sent from the second host 121 to the first host 111.

[0082] An embodiment that does not have the first receiving section 112 or the sending section 113 may be employed. Such embodiment is arranged such that power is fed to an interface board. In this, the int rface board and a printer correspond to the "second host" and the "interface apparatus", r spectively.

[0083] When a section such as the first receiving section 112 receives data and commands, an interrupt is generated for a CPU 131, and the CPU 131 executes reception-interrupting processing. Thus, the CPU 131 controls transmission. A program for implementing control that is executed by the CPU 131 is stored in a ROM 132 (read-only memory), and when the interface apparatus 101 is powered on, the CPU 131 reads out the program therefrom and executes it. At this time, varying the frequency of clocks to be fed to the CPU 131 allows reduction in power consumption.

[0084] The second sending section 123 sends commands and data that are received from the first host 111, and in addition, can post a notification on a current status of the interface apparatus 101 to the second host 121.

[0085] A power control section 133 receives power from the second host 121 and distributes the power to sections, such as the CPU 131, the first receiving section 112, the sending section 113, the second receiving section 122, and the sending section 123. In addition, it controls current, voltage, clocks, and the like, which are to be fed, and either turns them to a power-saving state or returns them from the power-saving state to a normal state. The power distribution is complicated, so that it is not shown in figures; however, a known technical method may be employed therefor.

[0086] A timer 134 is used to check whether or not a predetermined time has passed. For example, when intermittent operations are performed in a power-saving mode, the state is shifted between a normal-wait state and a power-saving-wait state; thereby, a power-saving function is implemented.

[0087] Data can be exchanged among the first receiving section 112, the sending section 113, the second receiving section 122, the second sending section 123, the CPU 131, and the ROM 132 via a bus 136.

[0088] To transfer data and commands from the side of the first host 111 to the bus 136, the first receiving section 112 performs conversion of voltage, current, impedance, frequency, protocol (communication procedures), and the like. To transfer data and commands from the bus 136 to the side of the second host 121, the second sending section 123 performs conversion of voltage, current, impedance, frequency, protocol, and the like. Depending on the case, the CPU 131 can governs the aforementioned conversions.

[0089] The ROM 132 can be used to store the device-type names and power-supply capacity data of the types of second host already available.

[0090] Also, the RAM 135 (random access memory) may be connected to the bus 136. The RAM 135 may be used either as a temporary storage area or as a

buffer area for data and commands that are transferred.

[0091] The second receiving section 122 and the sending section 123 function as sending and receiving means; the power control section 133 functions as a power-supplying means; the CPU 131 functions as a power-information receiving means and a determining means in cooperation with the second receiving section 122; the ROM 132 or the RAM 135 functions as a storing means; the CPU 131 functions as a second determining means in cooperation with the power control section 133; the first receiving section 112 functions as a receiving means; and the CPU 131 functions as a transferring means in cooperation with the sending section 123.

[0092] In the following description, the second host 121 may be referred to in a shortened form as a "host 121".

[0093] FIG. 7 is a flowchart showing power-saving determining processing of a first example of the embodiment of the interface apparatus according to the present invention. Hereinbelow, referring to FIG. 7, a description will be given of the first example of the power-saving determining processing.

[0094] When the host 121 is powered on, the power is supplied to the interface apparatus 101; thereby, initialization is started. Then, the power-saving determining processing starts (step S201a and step S201b).

[0095] First, the interface apparatus 101 and the host 121 perform initialization at the time of their activation (step S202a, step S202b).

[0096] Subsequently, the host 121 sends data of information on the power-supplying capacity of its own to the interface apparatus (step S203b), and the interface apparatus 101 receives the data (step S203a).

[0097] As the information on the power-supplying capacity, a rated power-supplying capacity, a peak power-supplying capacity, and the like can be considered. Also, together with the information or instead of the information, the device-type name of the host 121 may be transmitted.

[0098] Upon completion of the above transmission, the host 121 returns to a state where it is ready to perform normal processing (step S204).

[0099] The interface apparatus 101 acquires data on its own operating power requirement, which is prestored in the ROM 132 or the like, and checks whether the rated power-supplying capacity is larger than the required operating power (step S205).

[0100] If the rated power-supplying capacity is larger (YES at step 205), the system checks whether the peak power-supplying capacity is larger than the operating power (step S206). If the peak power-supplying capacity is larger (YES at step S206), a power-saving mode A is selected (step S207). If it is smaller (NO at step S206), a power-saving mode B is s lected (step S208). Thereafter, processing terminates (step S209).

[0101] If the peak power-supplying capacity is larger ("No" step at S205), the system checks whether the peak power-supplying capacity is larger than the operating power (step S210). If it is larger (YES at step S210), a power-saving mod C is sel cted (st p S211), and processing terminates (step S209). On th other hand, if the p ak power-supplying capacity is smaller (NO at step S210), sinc the int rface apparatus 101 cannot operate with the power supplied from the host 121, error processing is performed (step S212).

[0102] The error processing that can be considered includes that lamps (not shown) on the interface apparatus 101 are turned ON to blink, a buzzer (not shown) is turned ON to sound, or a status notification is posted to the host 121 so as to report to a user that the unit cannot be operated via the host 121.

[0103] The aforementioned power-saving modes A, B, and C that can be considered include the following:

(a) The power-saving mode A optimizes power-saving control, but does not perform the power-saving control when priority is given to the communication speed.

(b) The power-saving mode B either weakens the power-saving control or does not perform the power-saving control.

(c) Power-saving mode B always optimizes the power-saving control.

[0104] These various conditions and power-saving modes may be classified further in particular depending on the capacity of the interface apparatus 101, and an embodiment so arranged is included in the technical scope of the present invention.

[0105] FIG. 8 is a flowchart showing power-saving determining processing of a fifth example of an embodiment of the interface apparatus according to the present invention. Hereinbelow, referring to FIG. 8, a description will be given of a second example of embodiment of the power-saving determining processing.

[0106] Depending on the manufacturing period of the host 121, although the device-type name thereof can be sent to the interface apparatus 101, there ar cases where information on the power-supplying capacity may not be available. That is, there are cases wh re information on the rated power-supplying capacity and the peak power-supplying capacity cannot be obtained in step S203a and step S203b.

[0107] When the present example is employed, even in a case where a host 121 of such an old device type is connected, an appropriate power-saving mode can be selected.

[0108] Hereinbelow, assuming that the device-type name of the host 121 has been already exchanged in step S203a and step S203b, a description will be given of processing thereafter, because the processing theretofore is the same as in the case of the first example.

[0109] Using as key the device-type name of the

host 121, which was received in step S203a, the interface apparatus 101 searches a table stored in the ROM 132 (st p S301). FIG. 9 is an explanatory drawing showing a table of device-type names and data on the pow r-supplying capacity of an xample of the mbodiment of th power-saving d termining processing of the interface apparatus according to the present invention.

[0110] In a table 401, information is stored as one record 402 per device type comprising the device-type name stored in an area 403, the rated power-supplying capacity stored in an area 404, and the peak power-supplying capacity stored in an area 405.

[0111] As a result of the search process, if information that corresponds to the host 121 is detected ("DETECTED" in step S301), information on the rated power-supplying capacity and the peak power-supplying capacity that correspond to this device type is retrieved, thereby determining the power-saving mode (step S302). Thereafter, processing terminates (step S303). In the determining processing, processing steps similar to steps S205 to S212 in the first example may be employed.

[0112] As a result of the search process, if information that corresponds to the host 121 is not detected ("NOT REGISTERED" in step S301), a power-saving mode D that corresponds thereto is selected, an then processing terminates. As the power-saving mode D, the following can be considered:

- The power-saving control is not performed.
- Standard power-saving control is performed.
- Error processing is performed.

[0113] Hereinbelow, a description will be given of a sixth example corresponding to the fifth example of the power-saving determining processing of the interface apparatus. FIG. 10 shows a flowchart of a third example of a power-saving determining processing. Using the present example allows an appropriate power-saving mode to be selected even in a case where the device-typ name of the host 121 connected to the interface apparatus 101 is not registered in the table stored in the ROM 132 and even in a case where the host 121 cannot send the device-type name. For example, the cases are that processing is passed to step S304 in the fifth example.

[0114] This determining processing is started (step S501) when processing is passed to step S304. First of all, the CPU 131 controls the power control section so as to set an apparent resistance of the interface apparatus 101 to a load resistance in an average operation and measures the voltage supplied in the average operation. This allows an average load exerted on the host 121 to be known.

[0115] Subsequently, the apparent resistance of the interface apparatus 101 is set to be the lowest resistance during operation (step S503). That is, the above is a case where the maximum load is exerted on the host 121, at which time the maximum voltage is applied to the interface apparatus 101.

[0116] As a result, the voltage of the power supplied from the host 121 gradually decreases. FIG. 11 shows explanatory drawings that indicate variations in voltage of the power supplied in an example of the embodiment of the interface apparatus according to the present invention.

[0117] In addition to the above, the CPU 131 observes the condition of the voltage drop and determines whether or not the voltage reached a predetermined voltage within a predetermined period of time (step S504). In this case, for the predetermined voltage, the minimum voltage required for operation of the interface apparatus 101 may be employed.

[0118] When the voltage reaches the predetermined voltage within the predetermined period of time (YES at step S504), since the interface apparatus 101 cannot be driven with the power supplied by the host 121, error processing is performed (step S505). The error processing is similar to that at step S212 described above. The condition of the voltage drop in the above case is shown in FIG. 11(a).

[0119] When the voltage does not reach the predetermined voltage within the predetermined period of time (NO at step S504), power-saving control is determined so as to be selected corresponding to the value of voltage when the predetermine time passes (step S506). Thereafter, processing terminates (step S507). The larger the value of voltage, the higher is the capacity of the power source in the host 121. The condition of the voltage drop in the above case is shown in FIG. 11(b).

[0120] Calculations can be performed for the rated power-supplying capacity from the voltage in step S502 and for the peak power-supplying capacity from the voltage in step S504. With the calculation results thus obtained, processing similar to steps S205 to S212 in the first example can be performed in step S506.

[0121] For the predetermined time, for example, one second may be employed. Also, an embodiment may be employed which interprets a case where voltage variation ceased to the effect that the predetermined time passed over.

[0122] For the ROM 132, one of a flash EEPROM (electrically erasable programming ROM) and a hard disk may be employed. When the interface apparatus 101 is connected to a device of a type not stored in the ROM 132, the ROM 132 may be used to additionally store information on the power-supplying capacity, which was detected by performing experiments to vary the information on the power-supplying capacity, which was received from the second host 121, and the load exerted on the interface apparatus 101. In this case, the interface apparatus 101 of the present invention increases information in its storage and increasingly becomes more sophisticated each time it is connected to an unknown host.

[0123] Also, in step S203a, the interface apparatus 101 receives the power-supplying capacity and the device-type name from the host 121. In this context, an embodiment may be employed which is arranged such that in a case wher one of the interface apparatus 101 and the host 121 stores a table as shown in FIG. 9, they can exchange the table with each other to add new information not stored on the respective other side, thereby becoming even more sophisticated. An embodiment so arranged is also included in the technical scope of the present invention.

[0124] Also, there are many hosts of a type that cannot send information on the power-supplying capacity while they can send the device-type name. In this case, after a single experiment is carried out to recognize the device type, the information in the table stored in the ROM 132 can be used. This allows reduction in time for initialization and in the load of the power source for the host to be implemented.

[0125] To use the interface apparatus 101 as an interface between a printer and a computer, an embodiment may be such that the interface apparatus 101 of the present invention is entirely inserted into an extension slot of a printer. In such embodiment, since the interface apparatus 101 and the printer are integrated into a single unit, it looks like a single printer when viewed from the outside. Therefore, connection of cables and transportation can be easily carried out, and restrictions regarding the space for installation of components are reduced. Internally, two apparatuses, that is, the interface apparatus 101 and a printer, operate. However, each of the apparatuses is constructed to have a power-saving function; therefore, the integrated unit functions as a power-saving printer.

[0126] In addition, as described above, the present invention is applicable to any interface apparatus that receives power from any one of multiple hosts it interfaces. For example, the invention is applicable to network hubs and modems. Embodiments so arranged are also included in the technical scope of the present invention.

Industrial Applicability

[0127] As described above, according to the present invention, advantages described below are achieved.

[0128] First, an interface apparatus that allows data and commands to be transferred between two hosts so as to serve as an interface for communication therebetween, and shifts to a power-saving state as and when required, thereby allowing power consumption to be reduced, and that does not shift to the power-saving wait state during command reception, thereby allowing commands to be transferred at a high speed; and a control method therefor can be provided.

[0129] Second, an interface apparatus arranged such as that either one of a first host and a second host or both for which the interface apparatus serves as an interface can recognize a current status of the interface apparatus and a control method therefore can b provided. The host that received a notification can eith r shift to a power-saving wait state or return to a normal-wait state, thereby allowing a high communication speed to be maintained.

[0130] Third, an interface apparatus arranged such that transition of the interface apparatus to the pow r-saving wait state can be controlled via the first host, and the transition can be inhibited, thereby allowing data and commands to be transferred at a high speed; and a control method therefor can be provided.

[0131] Particularly, an interface apparatus arranged such that the first host recognizes a current status of th interface apparatus, thereby allowing precise pow r-saving control to be implemented; and a control method therefor can be provided.

[0132] Fourth, an interface apparatus arranged such that it receives power required for operation from the connected host and obtains information required for saving power from the host, thereby being capable of independently determining the power-saving mode, and a control method therefor can be provided.

[0133] Fifth, an interface apparatus arranged such that it can determine a mode most suitable to the power-supplying capacity of a host even in a case where the host cannot send power-supplying capacity information on its own while it can send the device-type name, and a control method therefor can be provided.

[0134] Sixth, an interface apparatus arranged such that it experimentally measures the power-supplying capacity of a host in a case where the host can not even send the power-supplying capacity information nor can it send information on the device-type name, ther by determining the power-saving mode most suitabl to the power-supplying capacity of the host, and a control method therefor can be provided.

[0135] Seventh, an interface apparatus that can serve as an interface for data transfer between two hosts, and an control method can be provided.

[0136] Eighth, an information-storing medium containing a program can be easily distributed or sold ind - pendently of the interface apparatus. By execution of the program recorded on the information-storing medium of the present invention in the interface apparatus, the interface apparatus and the control method therefore according to the above-described present invention can be realized.

[0137] Particularly, any one of a compact disk (so-called a CD-ROM), a floppy disk, an optical magnetic disk, a digital videodisk (so-called a DVD-ROM), and a magnetic tape can be employed as the information-storing medium containing the program. Using one of these information-storing medium, these programs can be install d in existing interface apparatuses.

[0138] In addition, these programs can be registered at a WWW (World Wide Web) site so as to allow

users to download and install them on existing interface apparatuses.

[0139] Also, in the above, a printer as a host and a computer as another host are individually employed and described. However, other electronic information apparatuses can be easily employed as hosts, and embodiments so arranged are included in the technical scope of the present invention.

[0140] Also, the interface apparatus of the present invention can be applied to a network hub, a modem, or the like that serve as an interface for multiple units such as computer.

[0141] Furthermore, the present invention can be applied to an embodiment arranged such that, between a printer and an interface board to be installed in the printer, the interface board supplies power to the printer.

<u>Reference Numerals</u>

[0142]

101	interface apparatus
111	first host
112	first receiving section
113	sending section
121	second host
122	second receiving section
123	sending section
131	CPU
132	ROM
133	power control section
134	timer
135	RAM
136	bus
201	normal-wait state
202	power-saving state
203	command-wait state
211	first transition
211	a first-a transition
212	second transition
213	third transition
214	fourth transition
215	fifth transition
216	sixth transition
401	table
402	device-type record
403	area for device-type name
404	area for rated power-supplying capacity
405	area for peak power-supplying capacity

Claims

1. An interface apparatus having receiving means for receiving data from a first host unit and sending means for sending the data received by the receiving means from the first host unit to a second host unit, characterized by comprising wait-state selecting means for selecting a predetermined wait state from a plurality of wait states according to operation of one of the receiving means and the sending means.

2. The interface apparatus as stated in claim 1, characterized in that the wait-state selecting means comprises:

   control-command detecting means for interpreting the data received from the first host unit to extract control commands,
   normal-wait-state selecting means for selecting a normal-wait state when the data was found by the control-command detecting means to be data other than a control command,
   command-wait-state selecting means for selecting a command-wait state when the data was found by the control-command detecting means to be a control command,
   command-completion recognizing means for recognizing completion of a control command extracted by the control-command detecting means,
   command-wait-state resetting means for resetting the command-wait state and selecting the normal-wait state when completion of the control command is recognized by the command-completion recognizing means,
   first clock means for counting the time passed after the normal-wait state is selected, and
   power-saving-wait-state selecting means for resetting the normal-wait state and selecting a power-saving wait state when a predetermined time was found by the first clock means to have passed after the normal-wait state is selected.

3. The interface apparatus as stated in claim 2, characterized by further comprising first notifying means for posting a notification to the first host unit when the power-saving wait state is selected by the power-saving-wait-state selecting means.

4. The interface apparatus as stated in one of claims 2 and 3, characterized by further comprising second notifying means for posting a notification to the second host unit when the power-saving wait state is selected by the power-saving-wait-state selecting means.

5. The interface apparatus as stated in one of claims 2 to 4, characterized in that the wait-state selecting means comprises:

   second clock means for counting the time passed after the power-saving wait state is selected, and
   power-saving-wait-state resetting means for resetting the power-saving wait state and

selecting the normal-wait state when a predetermined time is found by to the second clock means to have passed aft r the power-saving wait state is s lect d.

6. The interface apparatus as stated in claim 5, characterized by further comprising third notification means for posting a notification to the first host unit when the power-saving wait state is reset by the power-saving-wait-state resetting means.

7. The interface apparatus as stated in one of claims 5 and 6, characterized by further comprising fourth notification means for posting a notification to the second host unit when the power-saving wait state is reset by the power-saving-wait-state resetting means.

8. The interface apparatus as stated in one of claims 1 to 7, characterized by comprising:

control-command interpreting means for interpreting a control command detected by the control-command detecting means, and
power-saving-wait-state inhibiting means for inhibiting selection of the power-saving wait state by the power-saving-wait-state selecting means when a predetermined control command is interpreted by the control-command interpreting means.

9. A control method for an interface apparatus, having a receiving step for receiving data from a first host unit and a sending step for sending the data received in the receiving step from the first host unit to a second host unit, characterized by comprising:

(a) a step for selecting a predetermined wait state from a plurality of wait states according to operation of one of the receiving step and the sending step.

10. The control method for an interface apparatus as stated in claim 9, characterized in that the wait-state selecting step (a) comprises:

(b) a step for interpreting the data received from the first host unit to extract control commands,
(c) a step for selecting a normal-wait state when the data was found to be data other than a control command in the control-command detecting step (b),
(d) a step for selecting a command-wait state when the data was found to be a control command in the control-command detecting step (b),
(e) a step for recognizing completion of a control command extracted in the control-command detecting step (b),
(f) a step for resetting the command-wait state and selecting the normal-wait state when completion of the control command is recognized in the command-completion recognizing step (e),
(g) a step for counting the time passed after the normal-wait state is selected, and
(h) a step for resetting the normal-wait stat and selecting a power-saving wait state wh n a predetermined time was counted in the counting step (g).

11. The control method for an interface apparatus as stated in claim 10, characterized by further comprising:

(i) a step for posting a notification to the first host unit when the power-saving wait state is selected by the power-saving-wait-state selecting step (h).

12. The control method for an interface apparatus as stated in one of claims 10 and 11, characterized by further comprising:

(j) a step for posting a notification to the second host unit when the power-saving wait state is selected in the power-saving-wait-state selecting step (h).

13. The control method for an interface apparatus as stated in one of claims 10 to 12, characterized in that the wait-state selecting step (a) comprises:

(k) a step for counting the time passed after the power-saving wait state is selected, and
(l) a step for resetting the power-saving wait state and selecting the normal-wait state when a predetermined time was counted in th counting step (k).

14. The control method for an interface apparatus as stated in claim 13, characterized by further comprising:

(m) a step for posting a notification to the first host unit when the power-saving wait state is reset in the power-saving-wait-state resetting step (l).

15. The control method for an interface apparatus as stated in one of claims 13 and 14, characterized by further comprising:

(n) a step for posting a notification to the second host unit when the power-saving wait state is reset in the power-saving-wait-state resetting

step (l).

16. The control method for an interface apparatus as stated in one of claims 10 to 15, characterized by comprising:

(o) a step for interpreting a control command detected in the control-command detecting step (b), and
(p) a step for inhibiting selection of the power-saving wait state in the power-saving-wait-state selecting step when a predetermined control command is interpreted in the control-command interpreting step (o).

17. A computer-readable information-recording medium for storing a computer program for implementing a control method for an interface apparatus, characterized by comprising:

(z) a step for receiving data from a first host unit,
(y) a step for sending the data received in the receiving step (z) from the first host unit to a second host unit, and
(a) a step for selecting a predetermined wait state from a plurality of wait states according to operation of one of the receiving step and the sending step.

18. The information-recording medium as stated in claim 17, characterized in that the wait-state selecting step (a) comprises:

(b) a step for interpreting the data received from the first host unit to extract control commands,
(c) a step for selecting a normal-wait state when the data was found to be data other than a control command in the control-command detecting step (b).
(d) a step for selecting a command-wait state when the data was found to be a control command in the control-command detecting step (b),
(e) a step for recognizing completion of a control command extracted in the control-command detecting step (b),
(f) a step for resetting the command-wait state and selecting the normal-wait state when completion of the control command is recognized in the command-completion recognizing step (e),
(g) a step for clocking time passed after the normal-wait state is selected, and
(h) a step for resetting the normal-wait state and selecting a power-saving wait state when a predetermined time was clocked in the clocking step (g).

19. The information-recording medium as stated in claim 18, characterized by further comprising:

(i) a step for posting a notification to the first host unit when the power-saving wait state is selected in the power-saving-wait-state selecting step (h).

20. The information-recording medium as stated in one of claims 18 and 19, characterized by further comprising:

(j) a step for posting a notification to the second host unit when the power-saving wait state is selected by the power-saving-wait-state selecting step (h).

21. The information-recording medium as stated in one of claims 18 to 20, characterized in that the wait-state selecting step (a) comprises:

(k) a step for clocking time passed after the power-saving wait state is selected, and
(l) a step for resetting the power-saving wait state and selecting the normal-wait state when a predetermined time was clocked in the clocking step (k).

22. The information-recording medium as stated in claim 21, characterized by further comprising:

(m) a step for posting a notification to the first host unit when the power-saving wait state is reset in the power-saving-wait-state resetting step (l).

23. The information-recording medium as stated in one of claims 21 and 22, characterized by further comprising:

(n) a step for posting a notification to the second host unit when the power-saving wait state is reset in the power-saving-wait-state resetting step (l).

24. The information-recording medium as stated in one of claims 18 to 23, characterized by comprising:

(o) a step for interpreting a control command detected in the control-command detecting step (b), and
(p) a step for inhibiting selection of the power-saving wait state in the power-saving-wait-state selecting step when a predetermined control command is interpreted in the control-command interpreting step (o).

25. The interface apparatus as stated in claim 1, char-

acterized by further comprising power-supplying means having a plurality of power-saving modes and which suppli s power supplied from the first host unit to the interface apparatus, wh rein the wait-state selecting means comprises:

power-information receiving means for receiving power-supplying capacity information of the first host unit via the sending and receiving means, and
first determining means for determining the power-saving mode employed by the power-supplying means according to the power-supplying capacity information of the first host unit, which was received from the power-information receiving means.

26. The interface apparatus as stated in claim 25, characterized in that

the wait-state selecting means comprises storing means for storing a pair of device-type-name information of the first host and the power-supplying capacity information of the first host;
the power-supplying capacity information of the host, which is received from the power-information receiving means, includes the device-type-name information of the first host; and
the determining means searches the storing means using as a key data of the device-type-name information of the host, which was received from the power-information receiving means and determines the power-saving mode employed by the power-supplying means according to the obtained power-supplying capacity information of the first host.

27. The interface apparatus as stated in one of claims 25 and 26, characterized in that the wait-state selecting means comprises second determining means for recognizing variation in voltage and/or current of power supplied by the first host, thereby determining the power-saving mode employed by the power-supplying means.

28. The control method for an interface apparatus, as stated in claim 9, characterized by further comprising:

(b) a step that comprises a plurality of power-saving modes and that supplies power supplied from the first host to the interface apparatus, wherein the wait-state selecting step (a) comprises:
(c) a step for receiving power-supplying capacity information of the first host via the receiving step (z); and
(d) a first determining step for determining the power-saving mode employed by the power-supplying means according to power-supplying capacity information of th first host, which was rec ived in the power-information receiving step.

29. A control method for an interface apparatus, as stated in claim 28, characterized in that the wait-state selecting step (a) comprises:

(e) a step for storing a pair of device-type-name information of the first host and power-supplying capacity information of the first host; and
the first determining step (d) searches the storing means using as a key data of device-type-name information included in the power-supplying capacity information of the host, which was received in the power-information receiving step (c), and determines the power-saving mode employed by the power-supplying means according to the obtained power-supplying capacity information of the first host.

30. The control method for an interface apparatus, as stated in one of claims 28 and 29, characterized in that the wait-state selecting step (a) comprises:

(f) a step for recognizing variation in voltage and/or current of power supplied by the first host, and
(g) a second determining step for determining the power-saving mode employed in the power-supplying step (b) according to the result of the recognition in the recognizing step.

31. The information-storing medium as stated in claim 17, characterized by further comprising:

(b) a step that comprises a plurality of power-saving modes and that supplies power supplied from the first host to the interface apparatus, wherein the wait-state selecting step (a) comprises:
(c) a step for receiving power-supplying capacity information of the first host via the receiving step (z); and
(d) a first determining step for determining the power-saving mode employed by the power-supplying means according to power-supplying capacity information of the first host, which was received in the power-information receiving step.

32. The information-storing medium as stated in claim 31, characterized in that the wait-state selecting step (a) comprises:

(e) a step for storing a pair of device-type-name information of the first host and power-supplying capacity information of the first host; and

the first determining step (d) searches the storing means using as a key data of device-type-name information included in the power-supplying capacity information of the host, which was received in the power-information receiving step (c), and determines the power-saving mode employed by the power-supplying means according to the obtained power-supplying capacity information of the first host.

33. The information-storing medium as stated in one of claims 31 and 32, characterized in that the wait-state selecting step (a) comprises:

(f) a step for recognizing variation in voltage and/or current of power supplied by the first host, and

(g) a second determining step for determining the power-saving mode employed in the power-supplying step (b) according to the result of the recognition in the recognizing step.

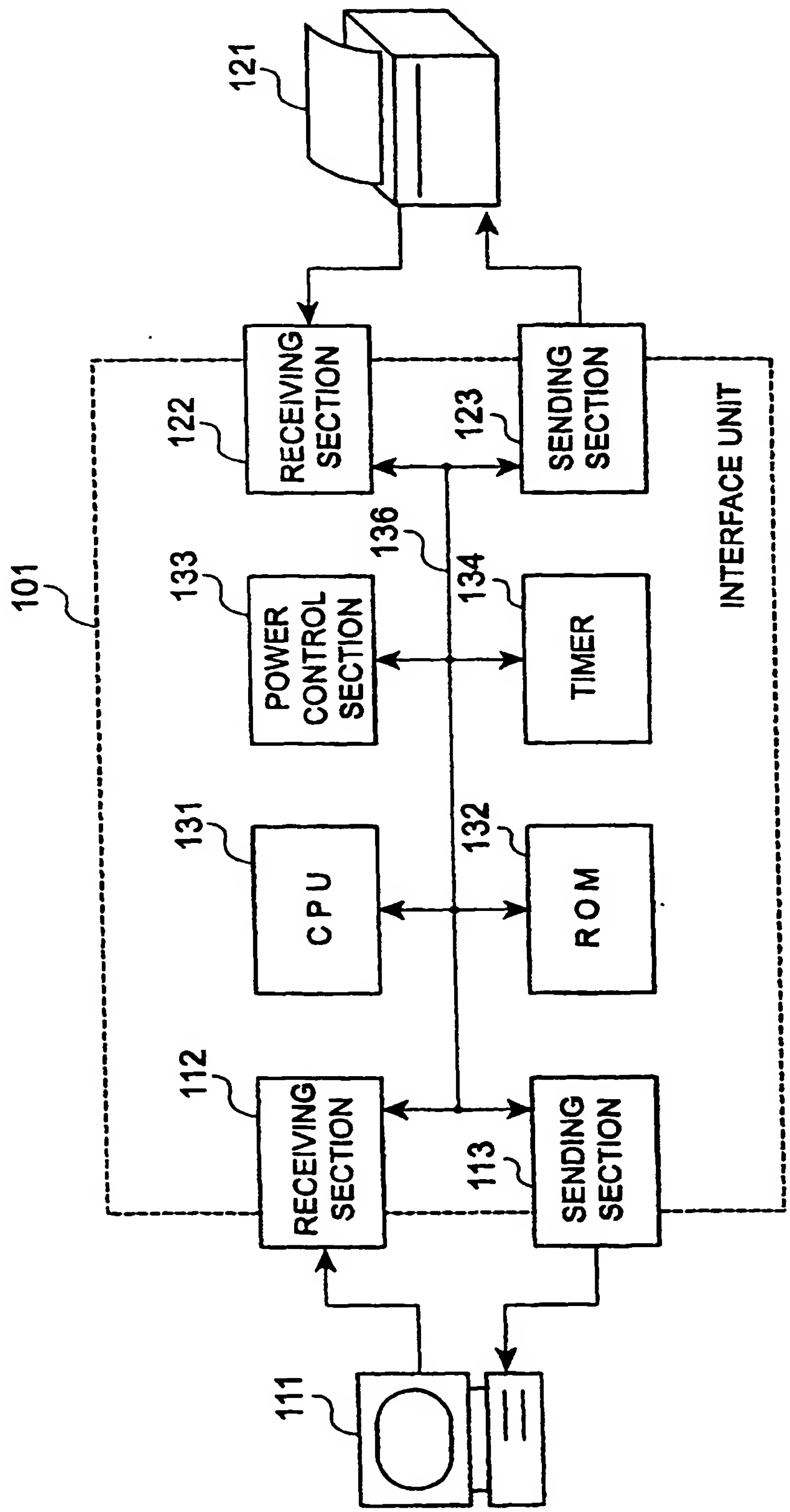

121
122
RECEIVING SECTION
123
SENDING SECTION
101
133
POWER CONTROL SECTION
136
134
TIMER
INTERFACE UNIT
131
CPU
132
ROM
112
RECEIVING SECTION
113
SENDING SECTION
111

FIG.1

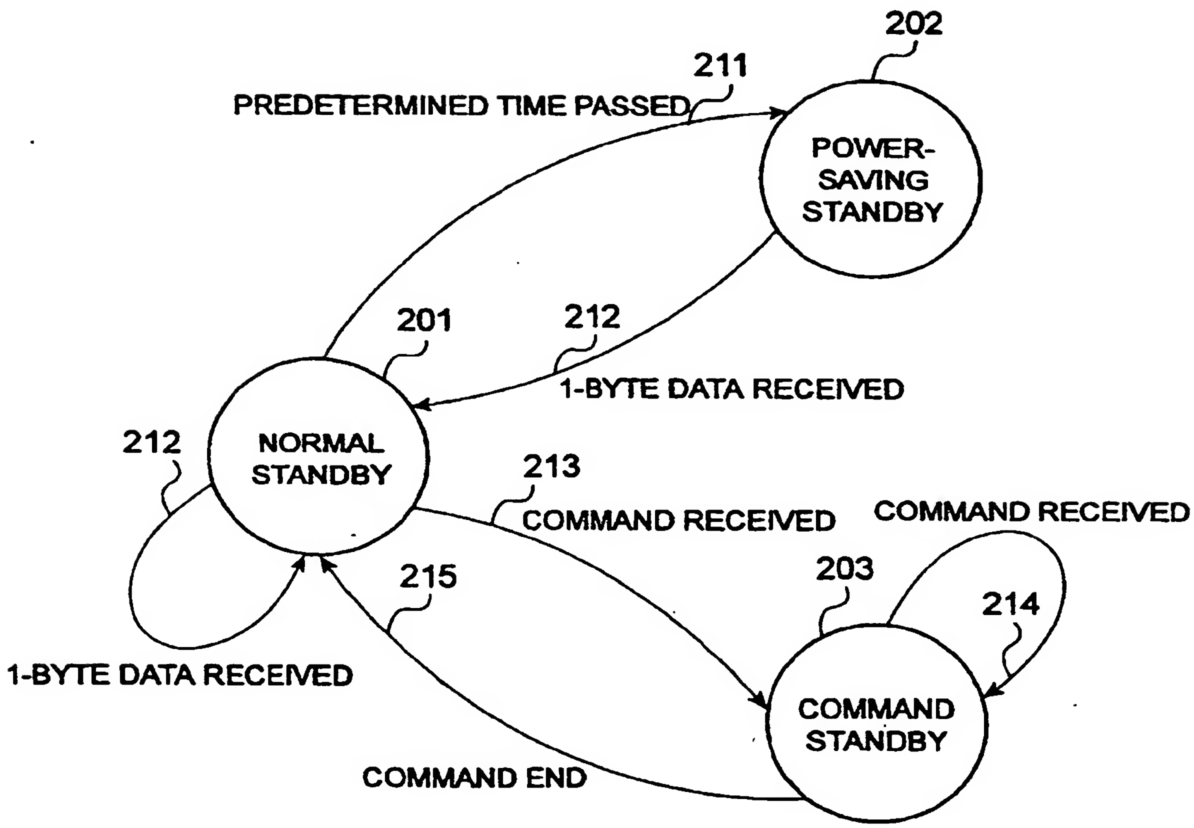
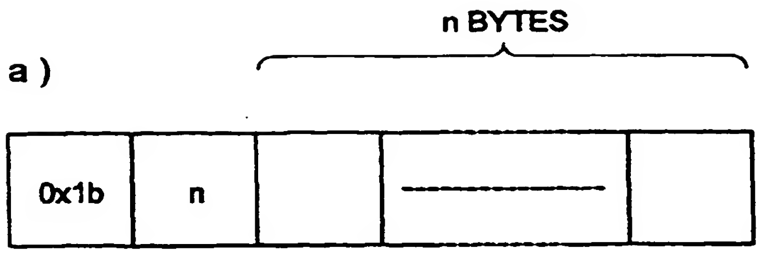

202
211
PREDETERMINED TIME PASSED
POWER-SAVING STANDBY
201
212
1-BYTE DATA RECEIVED
212
NORMAL STANDBY
213
COMMAND RECEIVED
COMMAND RECEIVED
215
203
214
1-BYTE DATA RECEIVED
COMMAND STANDBY
COMMAND END

FIG.2

(a)



(b)

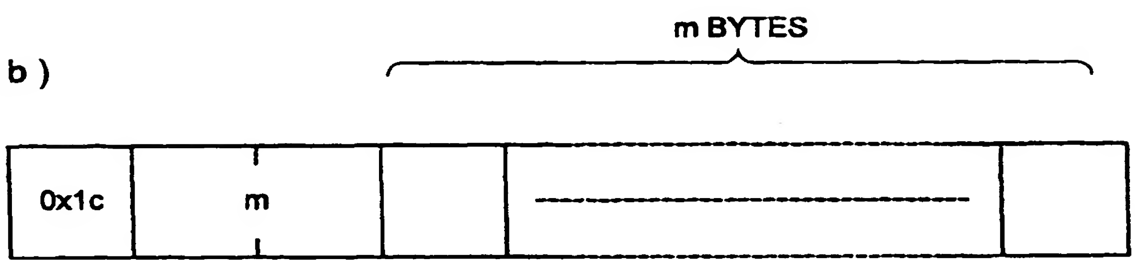


FIG.3

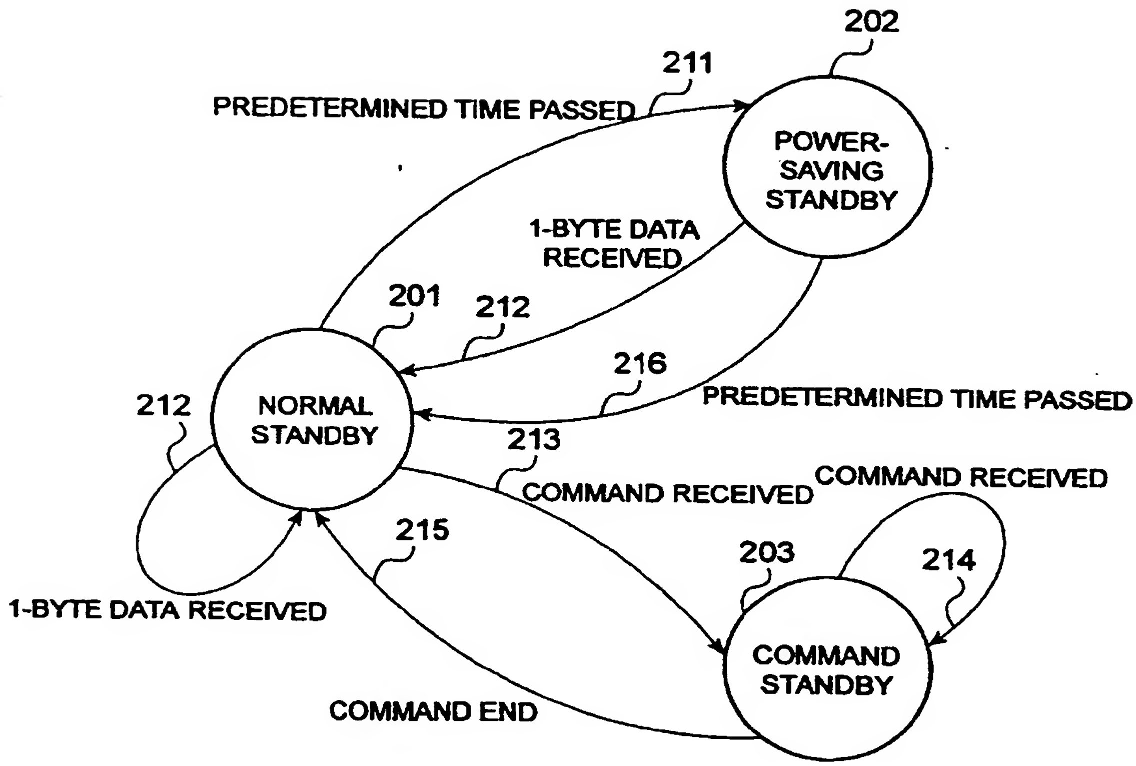

202
211
PREDETERMINED TIME PASSED
POWER-
SAVING
STANDBY
1-BYTE DATA
RECEIVED
201
212
216
PREDETERMINED TIME PASSED
212
NORMAL
STANDBY
213
COMMAND RECEIVED
COMMAND RECEIVED
215
203
214
1-BYTE DATA RECEIVED
COMMAND
STANDBY
COMMAND END

FIG.4

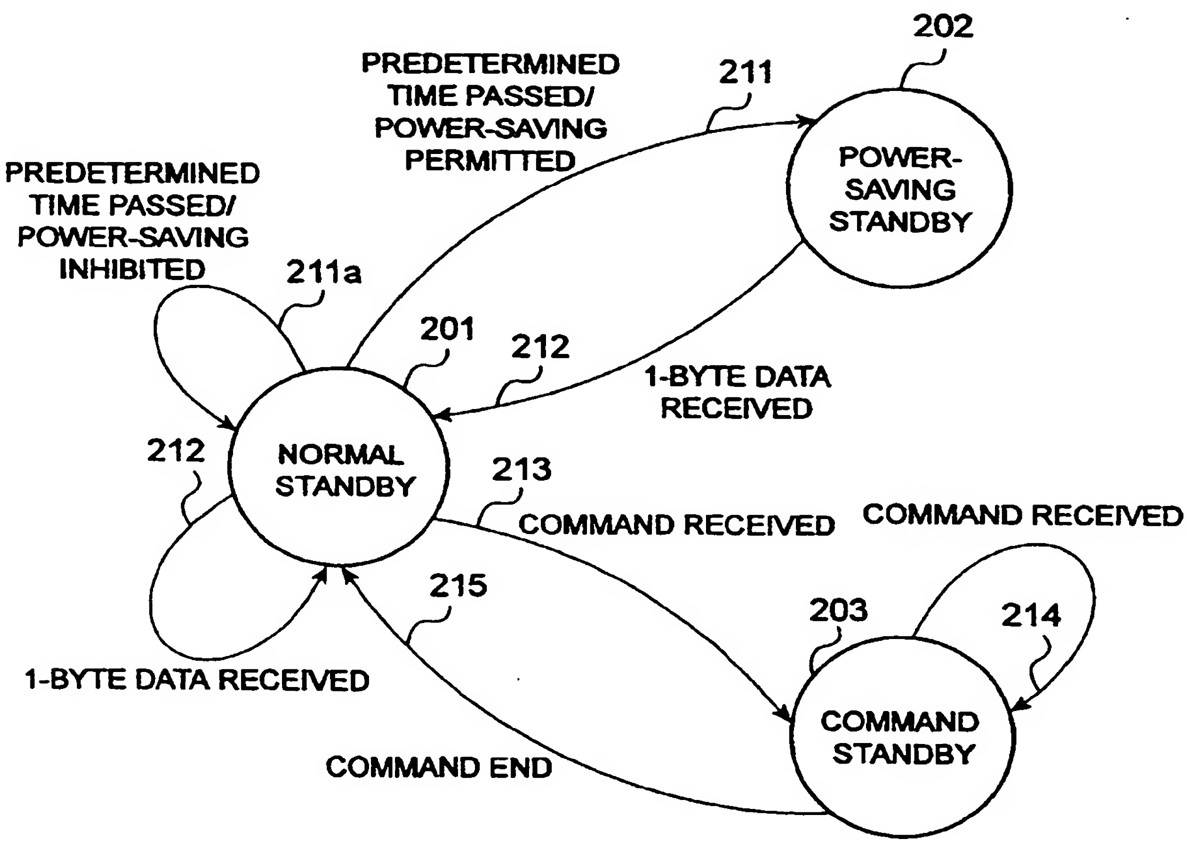

202
211
PREDETERMINED
TIME PASSED/
POWER-SAVING
PERMITTED
POWER-
SAVING
STANDBY
PREDETERMINED
TIME PASSED/
POWER-SAVING
INHIBITED
211a
201
212
1-BYTE DATA
RECEIVED
212
NORMAL
STANDBY
213
COMMAND RECEIVED
COMMAND RECEIVED
215
203
214
1-BYTE DATA RECEIVED
COMMAND
STANDBY
COMMAND END

FIG.5

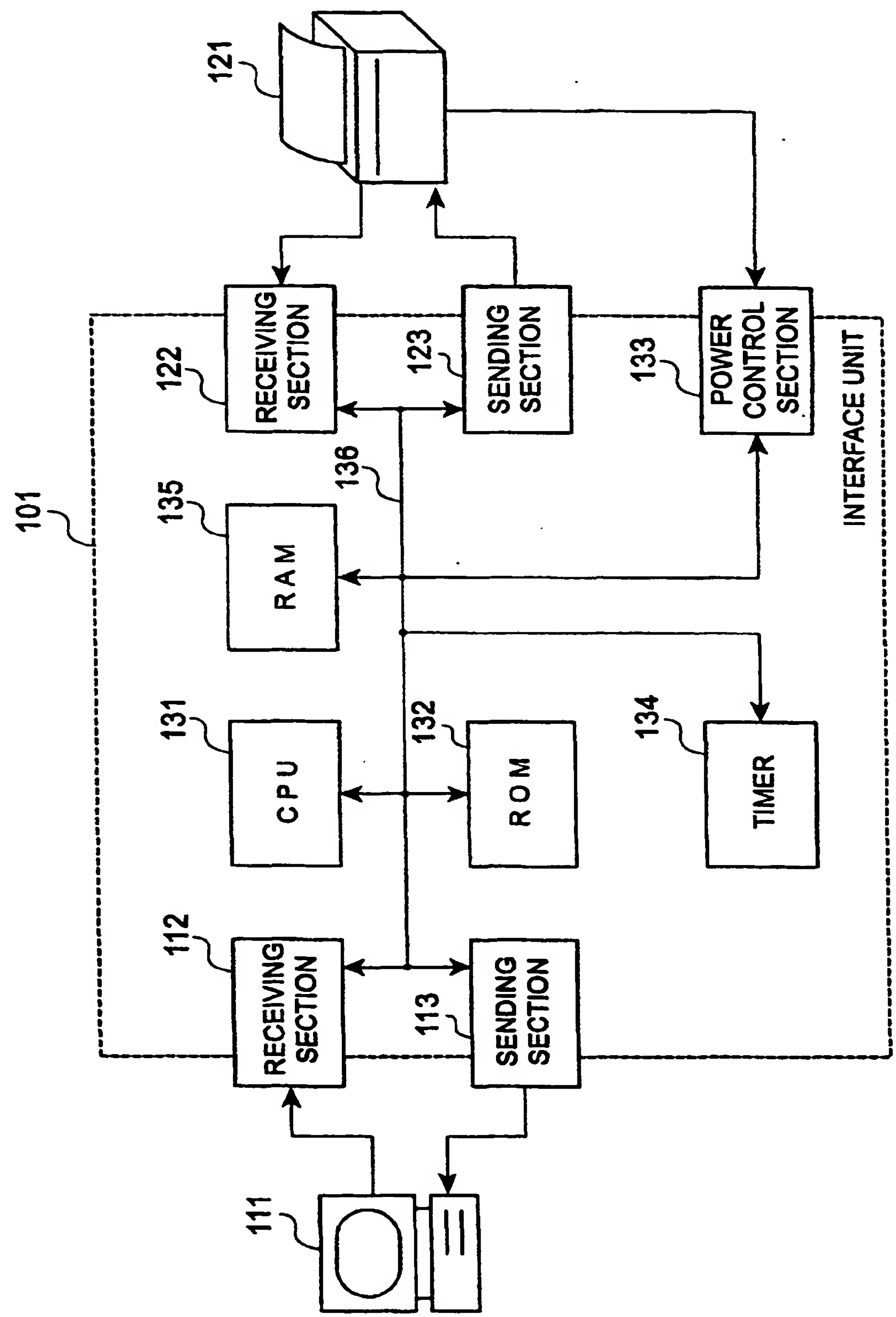

101
111
112
RECEIVING SECTION
113
SENDING SECTION
121
122
RECEIVING SECTION
123
SENDING SECTION
131
CPU
132
ROM
133
POWER CONTROL SECTION
134
TIMER
135
RAM
136
INTERFACE UNIT

FIG.6

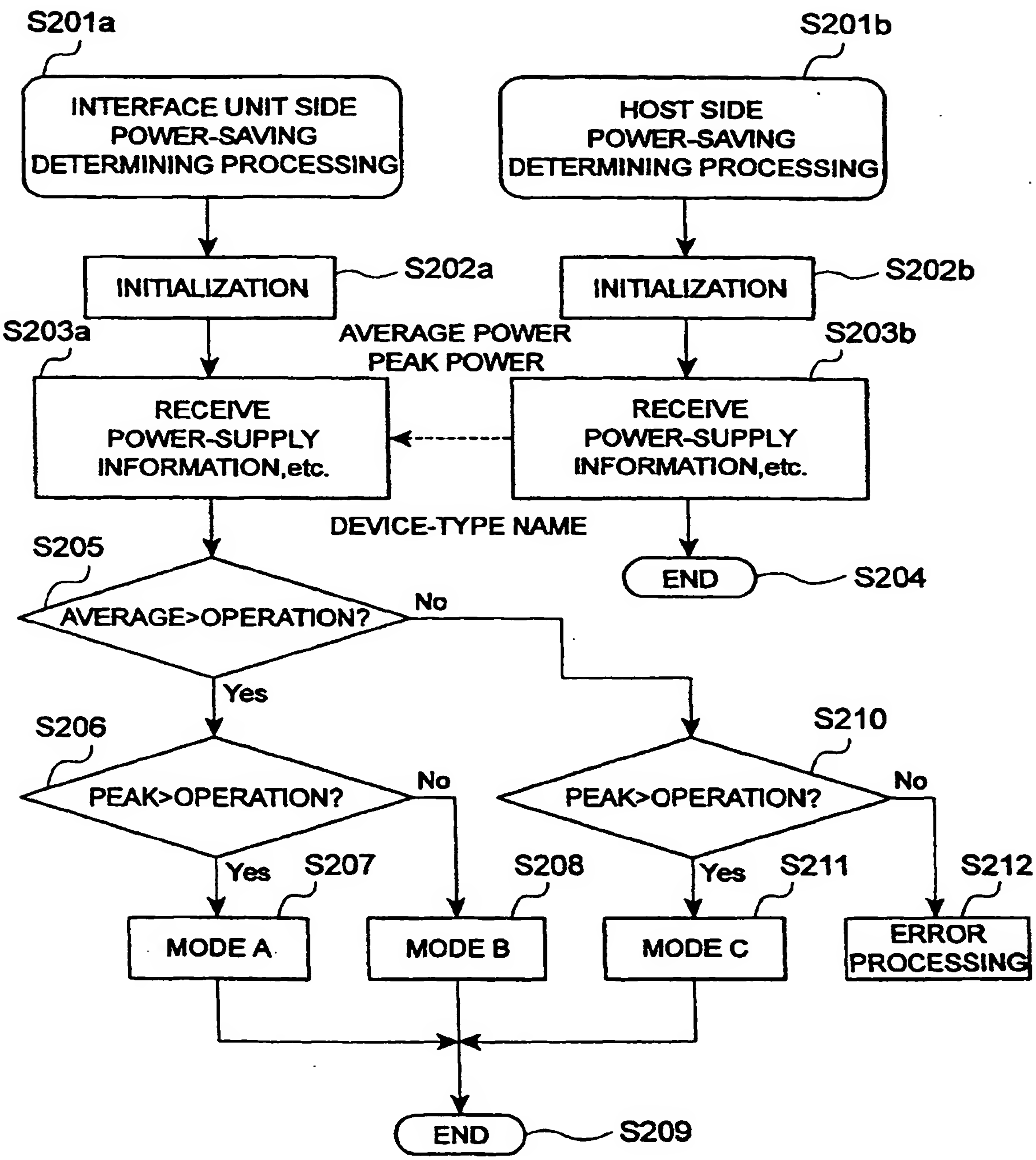

S201a
INTERFACE UNIT SIDE POWER-SAVING DETERMINING PROCESSING
S201b
HOST SIDE POWER-SAVING DETERMINING PROCESSING
INITIALIZATION
S202a
INITIALIZATION
S202b
S203a
AVERAGE POWER
PEAK POWER
S203b
RECEIVE POWER-SUPPLY INFORMATION,etc.
RECEIVE POWER-SUPPLY INFORMATION,etc.
DEVICE-TYPE NAME
S205
END
S204
AVERAGE>OPERATION?
No
Yes
S206
S210
PEAK>OPERATION?
No
PEAK>OPERATION?
No
Yes
S207
S208
Yes
S211
S212
MODE A
MODE B
MODE C
ERROR PROCESSING
END
S209

FIG.7

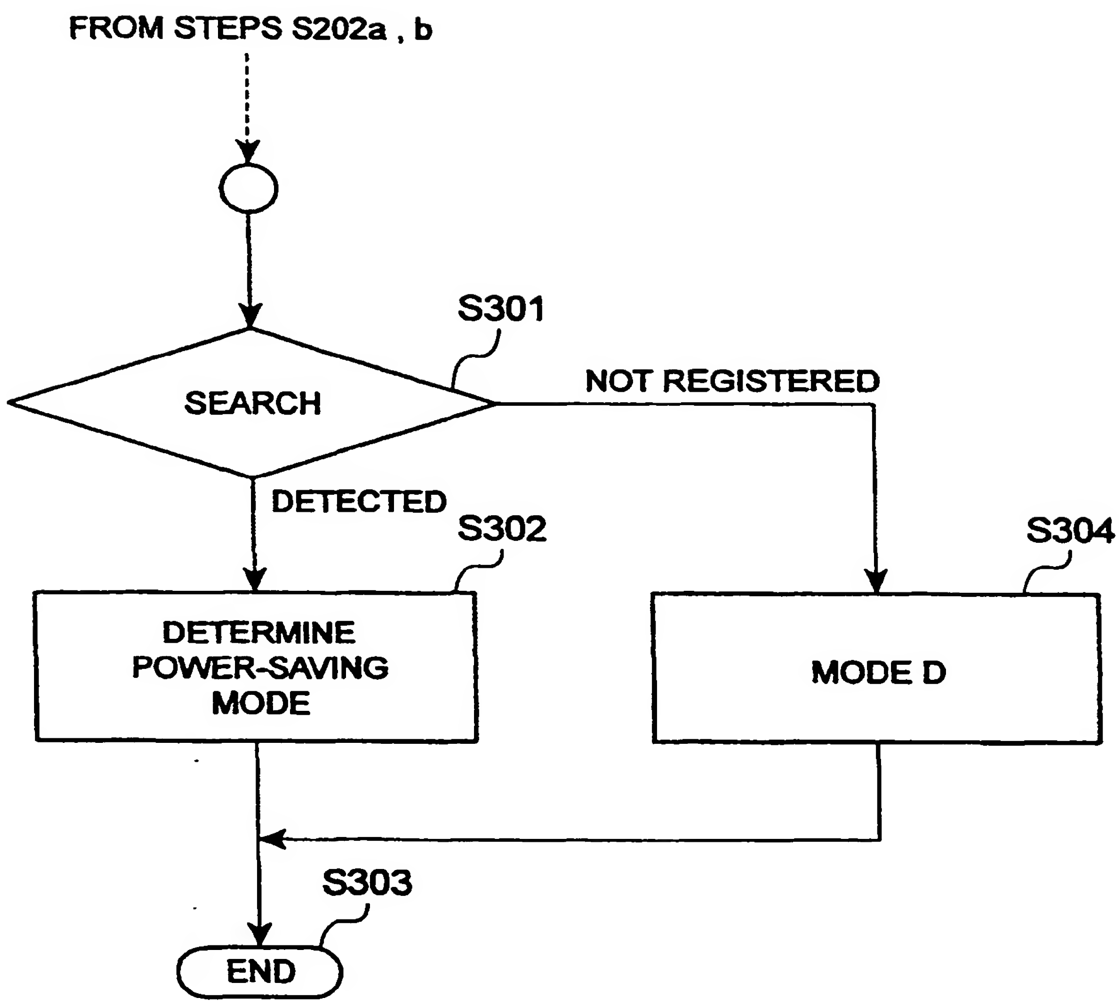

FROM STEPS S202a , b
S301
SEARCH
NOT REGISTERED
DETECTED
S302
S304
DETERMINE POWER-SAVING MODE
MODE D
S303
END

FIG.8

401

403	404	405	
LP-1500	10W	15W	402
LP-1700	11W	16W	
LP-2000	13W	17W	
LP-3000	18W	20W	
LP-8000	25W	30W	
⋮	⋮	⋮	

FIG.9

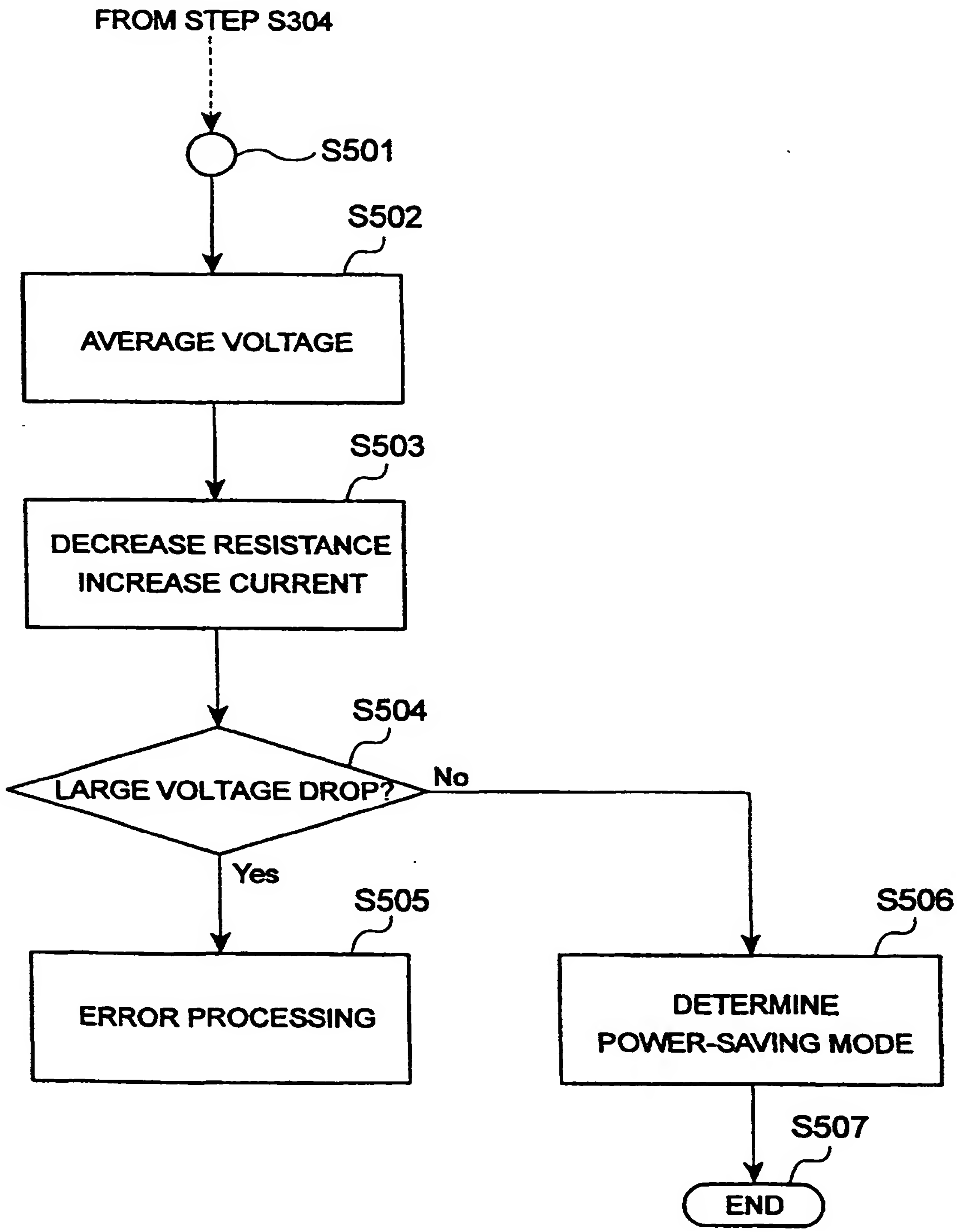
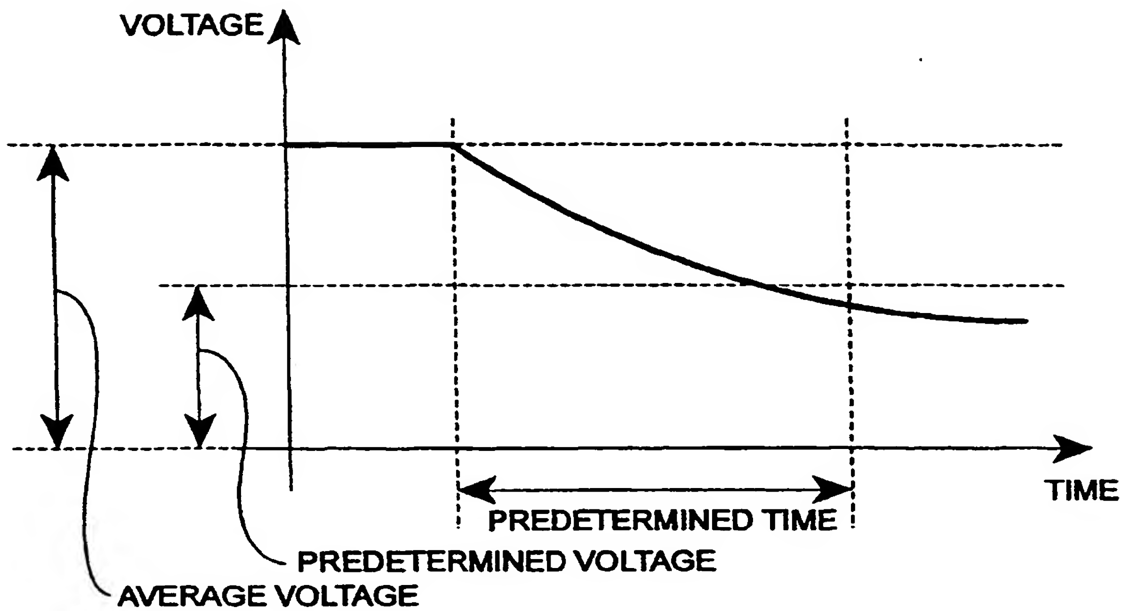

FROM STEP S304
S501
S502
AVERAGE VOLTAGE
S503
DECREASE RESISTANCE
INCREASE CURRENT
S504
LARGE VOLTAGE DROP?
No
Yes
S505
ERROR PROCESSING
S506
DETERMINE
POWER-SAVING MODE
S507
END

FIG.10

(a)


VOLTAGE
TIME
PREDETERMINED TIME
PREDETERMINED VOLTAGE
AVERAGE VOLTAGE

(b)

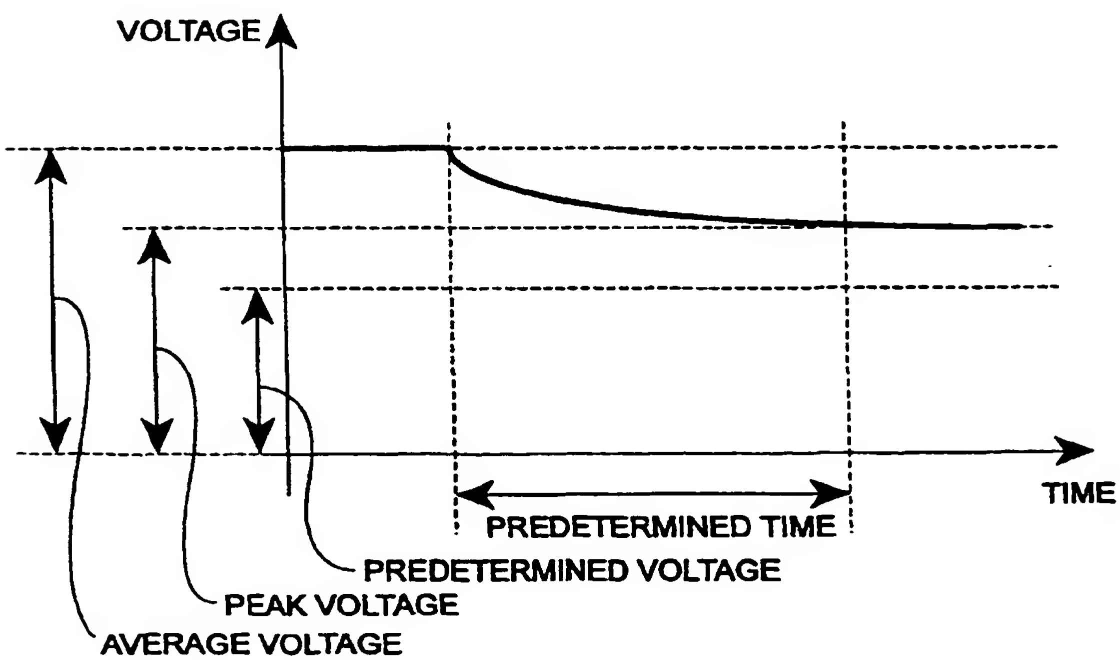

VOLTAGE
TIME
PREDETERMINED TIME
PREDETERMINED VOLTAGE
PEAK VOLTAGE
AVERAGE VOLTAGE

FIG.11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/06236

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] G06F1/32, G06F3/12, B41J29/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] G06F1/32, G06F3/12, B41J29/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Jitsuyo Shinan Toroku Koho	1996-2000
Kokai Jitsuyo Shinan Koho	1971-2000	Toroku Jitsuyo Shinan Koho	1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 10-136049, A (Hitachi, Ltd.), 22 May, 1998 (22.05.98) (Family: none)	1,9,17
X	JP, 5-35379, A (Hitachi, Ltd.), 12 February, 1993 (12.02.93) (Family: none)	1,9,17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 February, 2000 (01.02.00)	15 February, 2000 (15.02.00)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

Form PCT/ISA/210 (sec nd sheet) (July 1992)